;ritical currents of certain superconducting ıolybdenum sulfides

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We present the values of the critical current of superconducting ternary molybdenum sulfides, obtained by special heat treatment on the surface of a molybdenum foil. The current density decreases with increasing magnetic field, and is equal to 5×10^2 A/cm^2 in fields 120 kOe.

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It is known that a new type of superconducting molybdenum sulfide was re- ›ntly produced.[1–4] Some of these compounds had rather highsuperconducting ansition temperatures and quite high values of the upper critical field $H_{c2}(0)$, :ceeding, according to the latest data, 600 kOe.[5,6] The superconducting and agnetic properties of these compounds also have a number of singulari- es.[7,8]

From among the presently known ternary molybdenum sulfides, the largest alues of T_c and H_c are possessed by compounds with lead or tin as the third omponent, Mo_6PbS_8 and Mo_5SnS_6. It was of interest to determine the value of ıe critical currents for such systems.

We have prepared samples in the form of molybdenum ribbons measuring .5×2×50 mm, the surface of which was covered with the sulfide Mo-Pb-Sr r Mo-Sn-S. To this end, the molybdenum ribbon was treated in the vapors of ıe two other components, for example lead and sulfur, at a temperature 800— 000 °C for several hours. Depending on the treatment regime, the thickness f the sulfide layer ranged from several microns to a tenth of a millimeter. 'o prepare the current contact, the ends of the sample were electrolytically oated with copper and then tinned or coated with indium. In addition, we in- estigated samples in the form of relatively thick layers of the sulfide (0.1— .2 mm), separated from the molybdenum foil and glued with a thin layer of ıcquer on mica. The potential contacts were usually clamps, but in some cases /ere also prepared electrolytically.

Measurement of the critical currents and of their dependence on the magnetic ield were carried out either in a superconducting solenoid, or in a water- ooled copper solenoid at the International Laboratory for Magnetic Fields and 'emperatures (Wroclaw, Poland).[7] Permendur concentrators were used to ncrease the field.

Figure 1 shows the plot of the critical current against the magnetic field for Ло-Pb-S samples separated from the molybdenum, obtained in weak fields at :.2 °K. It shows also the current-voltage characteristic of such a sample. It is ;een that the critical current in weak fields decreases strongly with increasing nagnetic field.

Figure 2 shows plots of the critical current on the magnetic field for Mo-

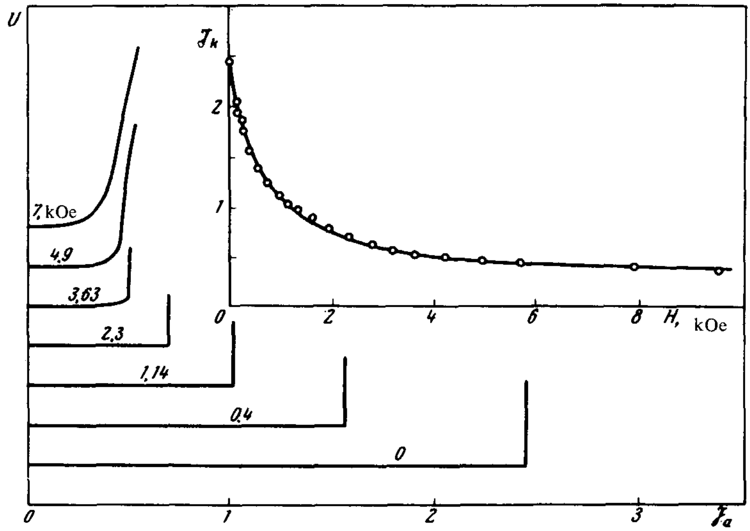

FIG. 1 Current-voltage characteristics and different fields and the dependence of the critical current on the magnetic field of the Pb-Mo-S sample separated from the molybdenum foil, $T = 4.2$ °K.

Pb-S sample on a molybdenum base, obtained at different temperatures in strong magnetic fields. It can be concluded from the data that the dependence of the critical current on the magnetic field at $T = 4.2$ °K and $H > 25$ kOe can be approximated roughly by a hyperbola.

The estimate of the density of the critical current j_{cr} for most samples investigated by us is a rather complicated matter, since it is difficult to determine the cross-section area of the phase responsible for the critical current. If, as a very rough estimate, we assume the cross section area of this phase

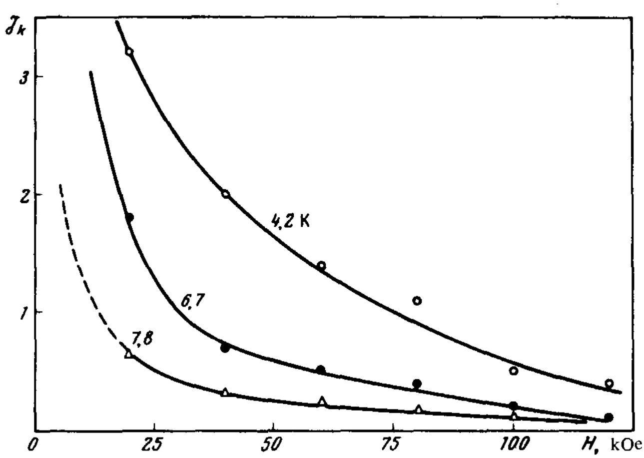

FIG. 2. Plot of $J_{cr}(h)$ obtained at different temperatures in strong magnetic fields for a Pb-Mo-S sample on a molybdenum base.

be equal to or smaller than 5×10^{-3} cm^2 (assuming the layer thickness to be ≤ 0.1 mm), then j_{cr} ($H = 100$ kOe) $\geq 5\times10^2$ A/cm^2. Recognizing that cracks may produced in the sulfide layer, and also that the current contacts were apparently not perfect enough, we can assume that the current density can be greatly increased. An improved manufacturing technology will probably make possible to obtain homogeneous samples with higher density of the critical current in strong magnetic fields.

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